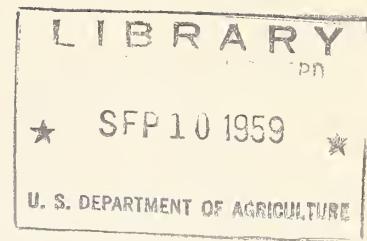


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Indexes of Factory Production of Domestic Farm Food Products

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U. S. DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Marketing Research Division

INDEXES OF FACTORY PRODUCTION OF DOMESTIC FARM FOOD PRODUCTS 1/

This article presents indexes for measuring annual changes in factory production of processed domestic farm food products for the period 1909-58 and discusses trends in these series. These index numbers were developed as a part of an investigation of changes in productivity of resources employed in marketing domestic farm food products. A more comprehensive report, including a discussion of methods, sources, and limitations of the indexes presented in this article will be published at a later date.

During the last 50 years, factory output of processed domestic farm foods has increased at an average rate of 2.6 percent per year, significantly faster than the population. About three-fourths of the rise in output can be associated with increased marketings of food products by farmers. And about a fourth was accounted for by shifts from on-farm and wholesale and retail processing to factory processing plus "more processing" per unit of farm product marketed. The picture has been about the same since the end of World War II.

When the period since World War I is considered as a whole, increases in output accounted for the major share of the rise in charges for processing (measured by "value added") domestic farm food products. But for the period since World War II, rising processing charges per unit of output accounted for the major share of the rise in total processing charges.

Measured by factory "value added," processing charges accounted for about a third of the total bill for marketing domestic farm food products bought by civilian consumers in this country in 1957. 2/ That year the total bill for assembly, transportation, processing, and distribution amounted to \$35.6 billion or about two-thirds of the sum consumers spent for these products. 3/ Both processing charges and the total marketing bill have increased sharply since the end of World War I, but the marketing bill has risen at a significantly faster rate. Consequently, processing charges now account for a smaller fraction of the marketing bill than they did during the interwar years. The ratio of processing charges to the total marketing bill declined only slightly from 1919 to 1939; the decrease in each decade from 1939 to 1958 was more substantial.

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2/ "Value added," as used in this article and in the Census of Manufactures, is "calculated by subtracting the cost of materials, supplies, and containers, fuel, purchased electric energy, and contract work from the total value of shipments." For an analysis of the "value added" concept applied to components of consumer expenditures for food, see Kenneth E. Ogren, "The Marketing Bill for Agricultural Products," Agricultural Economics Research, Vol. VII, No. 4, Oct. 1955, pp. 101-107, and "The Farmer's Share: Three Measurements," Agricultural Economics Research, Vol. VIII, No. 2, Apr. 1956, pp. 43-50.

3/ For a description of the marketing bill see pp. 10-21.

The rise in processing charges since World War I resulted from an increase of about 145 percent in the production of processed domestic farm foods combined with a 70-percent rise in unit fabricating charges.^{4/} In contrast, since 1947 unit fabricating charges have risen at a faster rate (about 30 percent) than physical output (about 25 percent). About 54 percent of the increase in processing charges during the entire four decades can be attributed to the rise in output, and 46 percent to higher unit fabricating charges; since the end of World War II, the proportions are exactly reversed -- 46 percent to increased production and 54 percent to higher unit charges.

Trends in Total and Per Capita Factory Production

Factory production of processed domestic farm food products increased about 240 percent from 1909 to 1958; more than half of the rise occurring during the last two decades (table 9).^{5/} During the first decade production rose 37 percent and in the second 10-year period the increase was 21 percent. But the Great Depression retarded growth and during the third decade production rose only 11 percent. Increased civilian consumption combined with greater military and export demands for farm foods resulted in a 44-percent rise in factory output during the World War II and early postwar period, 1939-47. Except for a slight dip in 1948, the index increased every year after 1947; it reached an alltime high in 1958 -- 28 points above the 1947-49 average. The indexes indicate the close relation of total factory production of farm foods to general economic activity. The sharpest relative increases occurred during periods of strong wartime demand; the smallest during the decade marked by the Great Depression.

During the last half century, the index of factory production of processed domestic farm food products rose at an average annual rate of nearly 2.6 percent (fig. 1).^{6/} This long-term average rate of growth was affected substantially by the upsurge during and after World War II: Since 1947, production has grown at the rate of 2.6 percent per year; from 1909 to 1939 the average annual rate was 1.9 percent.

^{4/} Unit fabricating charges were derived by dividing an index of total value added by an index of factory production. This ratio is, of course, subject to all the statistical errors -- and biases -- inherent in both the numerator and denominator. For example, the physical output index in this report, like all measures of physical output, probably has a downward bias due to its failure to reflect fully "quality" changes. The rise in unit fabricating charges is probably overstated by the extent of this bias.

^{5/} Factory production (and value added in factory production), as used in this article, includes production for civilian consumption, changes in stocks, exports, and Government purchases for military use and for various relief programs. For comparison with the farm food marketing bill, an index that reflected only civilian consumption of factory processed farm food would be better. But differences between a civilian consumption index and a production index would not be significant in comparing long-term trends, especially if World War II years, a period of relatively large military takings, were omitted. Indexes of civilian consumption of factory production are being constructed.

^{6/} Fig. 1 is a ratio (semilogarithmic) chart in which equal distances show equal rates of change. Thus, by comparing slopes we can compare visually average rates of growth in different time periods and in different series.

Table 9.—Factory production of domestic farm food products

(1947-49 = 100)

Year	All processed foods 1/	Meat products 2/	Dairy products 3/	Poultry and processed eggs 4/	Bakery and grain mill products 5/	Processed fruits and vegetables 6/	Sugar and confectionery products 7/	Miscellaneous products 8/
1909	38	52	13	—	57	20	42	21
1910	38	49	14	—	57	19	43	24
1911	40	55	16	—	58	23	49	23
1912	41	53	17	—	59	27	46	24
1913	41	53	19	—	59	24	56	25
1914	42	52	21	—	61	27	53	23
1915	44	56	23	—	62	25	58	26
1916	46	62	25	—	62	26	66	28
1917	47	58	28	—	62	32	61	29
1918	51	69	32	—	64	35	65	32
1919	52	68	35	—	67	32	52	35
1920	48	59	35	—	61	30	72	37
1921	46	56	38	—	56	23	69	37
1922	50	61	40	—	61	35	47	41
1923	54	70	45	—	63	39	49	41
1924	55	72	45	—	64	36	65	45
1925	56	67	48	—	63	49	66	43
1926	57	69	48	—	67	44	52	47
1927	58	69	51	—	69	41	53	50
1928	61	72	51	—	73	46	61	50
1929	63	73	56	37	75	48	69	49
1930	63	70	56	40	74	54	66	47
1931	59	69	54	36	69	43	59	44
1932	56	66	53	37	62	39	62	40
1933	56	69	53	41	57	44	65	45
1934	58	81	51	40	62	47	66	45
1935	59	64	54	38	64	58	72	45
1936	65	76	58	43	69	54	80	57
1937	67	71	61	40	70	68	80	58
1938	68	75	62	37	72	61	85	64
1939	70	79	64	45	74	61	86	66
1940	73	87	67	50	73	66	91	65
1941	79	90	72	60	74	82	97	78
1942	86	101	81	90	76	91	99	88
1943	90	114	83	113	81	88	92	94
1944	93	118	87	122	83	91	99	87
1945	95	106	95	105	92	90	95	90
1946	99	102	103	100	93	113	94	86
1947	101	105	101	92	101	97	102	98
1948	98	96	98	88	100	99	99	97
1949	101	99	100	120	99	104	99	105
1950	104	101	102	146	100	106	109	112
1951	106	100	103	164	103	124	99	110
1952	109	105	105	185	104	122	101	116
1953	113	113	109	207	103	129	104	122
1954	114	116	112	242	102	128	102	126
1955	119	125	117	271	104	135	97	133
1956	126	130	122	332	108	151	101	136
1957	126	124	124	353	111	144	107	139
1958	128	119	124	401	114	147	109	146

1/ Measures physical output of manufacturing establishments processing domestically produced farm food products. Output includes factory byproducts as well as foods. In general, the scope of the index is the same as that of the Census of Manufactures. All (4-digit) industry indexes are benchmarked to Census and Biennial Census of Manufactures data except those for poultry and processed eggs and processed fruits and vegetables.

2/ Includes output of meatpacking plants and establishments specializing in prepared meat products. The index measures some duplication (about 15 percent) before 1939 because of interplant shipments of fresh meats for further processing but the volume of such shipments relative to total shipments did not change sufficiently to affect seriously the index during those earlier years.

3/ Includes the output of establishments manufacturing mainly creamery butter, natural cheese, concentrated milk, ice cream and ices, special dairy products, and fluid milk and cream. Fluid milk and cream have been included only since 1929.

4/ Includes poultry slaughter in dressing plants, liquid, dried and frozen eggs, and canned poultry (since 1947). The definition of poultry dressing plants is that used in the "Commercial Poultry Slaughter Report," published by AMS since 1954. Factory slaughter before 1954 was estimated from sales of poultry off farms and other data.

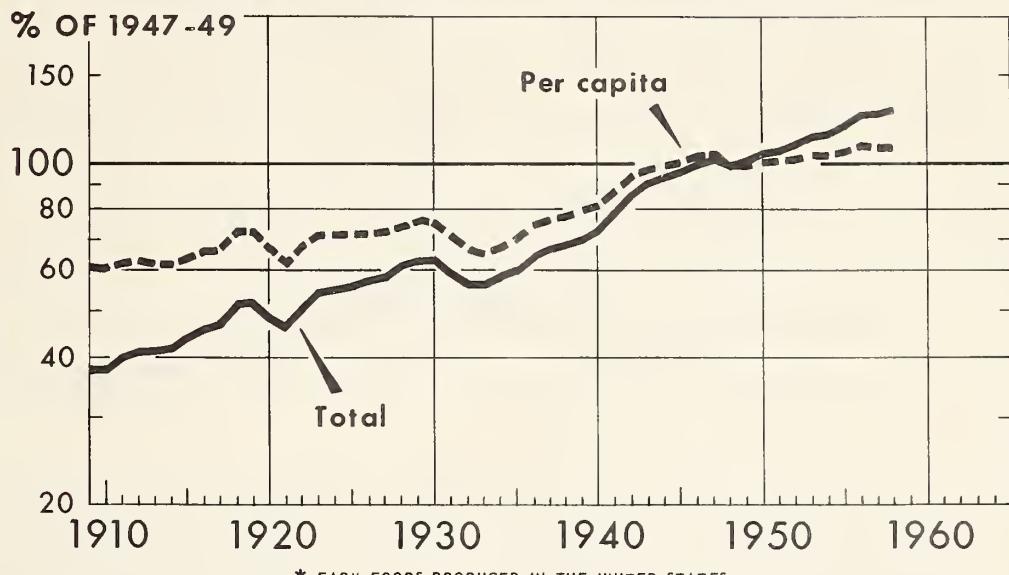
5/ Includes the output of establishments specializing in the production of flour and meal, cereal products, rice milling, bread and related products, and biscuits and crackers. The bread and related products industry includes wholesale bakeries, grocery chain bakeries, house-to-house bakeries, and retail multioutlet bakeries. The 1947 Census of Manufactures included establishments of multiunit enterprises with baking on the premises; these establishments were classified in retail trade in 1954 and, as a consequence, are not reflected in the production index. According to the Census of Manufactures, this change in classification did not significantly affect the comparability of statistics between 1947 and 1954 for bread and related products manufacturing establishments.

6/ Includes canned fruits and vegetables, dehydrated fruits and vegetables, pickles and sauces, and frozen fruits and vegetables; index based on pack data from various sources including National Canners Association and Western Canners and Packers Association.

7/ Includes establishments producing raw cane sugar, beet sugar, and confectionery products. Estimated output of refined domestic cane sugar also is included.

8/ Output of establishments producing leavening compound, shortening and cooking oils, margarine, corn wet milling products, flavorings, macaroni and spaghetti, and peanut butter. Census benchmark indexes are available for the first six series since 1929; before 1929, a "coverage adjustment" was used for missing industries during each census and biennial census year. These benchmark data have been interpolated on the basis of four of the series, shortening and cooking oils, margarine, corn wet milling, and peanut butter.

FACTORY PRODUCTION OF PROCESSED FARM FOODS*



* FARM FOODS PRODUCED IN THE UNITED STATES

U. S. DEPARTMENT OF AGRICULTURE

NEG. 7395-59 (7) AGRICULTURAL MARKETING SERVICE

Figure 1

From 1909 to 1958 factory production of domestic farm foods per person rose 77 percent (fig. 1). Factory production per capita increased 18 percent during the first decade; 6 percent in the second decade; and 3 percent in the third, depression-marked, decade. Between 1939 and 1947, per capita production rose 30 percent; since 1947 it has increased only 5 percent. Unlike total production, per capita output has not risen steadily since 1948.

Factors in the Rise of Factory Production

The long-term rise in factory production of domestic farm foods reflects (1) increased farm food marketings (mainly reflecting increased civilian consumption), (2) shifts from processing done on farms and in wholesale and retail establishments to factory processing, and (3) more factory processing per unit of farm food products marketed. The third factor, more factory processing per unit of marketings, includes "quality" changes such as a shift between fresh and processed pork, more and improved

packaging, and increased importance of so-called "convenience foods." 7/ The third component also reflects a rise in the proportion of total farm marketings being processed; for example, an increase in the proportion of fruits and vegetables being processed.

The index of volume of farm food marketings 8/ constructed by the Agricultural Marketing Service can be used to gauge the effect of the first factor. The difference between the factory production index and the marketings index can be used to measure the combined effects of the second and third factors -- shifts from nonfactory to factory processing and changes in the extent of fabricating services per unit of marketings.

Over the entire period, 1910-58, 9/ factory production rose 237 percent compared with an increase of 152 percent in marketings (fig. 2). Factory production outpaced marketings during each decade. During the last half century as a whole, about three-fourths of the rise in factory output can be associated with increased marketings and the remaining one-fourth was due to the combined effect of the other two factors. 10/ These proportions were about the same for both the period that followed World War II and the prewar period, 1910-39.

Although we cannot separate the effect of the shift between nonfactory and factory processing from the effect of the increased extent of fabricating, several illustrations will indicate that both of these factors were significant. For example, the ratio of farm plus nonfactory commercial slaughter of livestock to total slaughter (in live weight) declined from 39 percent in 1909 to 23 percent in 1947 and to 16 percent in 1954. Farmers retailed about 20 percent of total nonfarm consumption of fluid milk and cream in 1939 compared to 12 percent in 1947 and 5 percent in 1957. Fluid milk and cream make up an important component of the index of factory processed dairy products. The increased extent of factory

7/ As previously noted, the production index probably does not fully reflect quality changes. To continue the illustration in the text, it reflects a shift between fresh and processed pork products; it only partially reflects trends in packaging.

8/ Ernest W. Grove and Margaret F. Cannon, New Index Numbers of Farm Marketings and Home Consumption, U.S. Dept. Agr., AH-107, Agr. Mktg. Serv., July 1956. The most important conceptual and statistical problem in the present use of this index is that marketings include net quantities placed under Commodity Credit Corporation loan. If we adjusted the index for food grains held under CCC purchase and loan programs the increase would be 10 percent less between 1937 and 1958 than the series actually used. To this extent, the importance of the first factor -- increased marketings -- is overstated.

9/ The index of farm food marketings begins in 1910.

10/ The technique for separating an increment of change into its components is based on a method outlined for a similar problem by Frederick C. Mills in Productivity and Economic Progress, National Bureau of Economic Research, Occasional Paper 38, (1952), pp. 31-36. The figure for the relative contribution for the entire four decades was computed decade by decade in order to reduce the "interaction factor." For that reason the difference in the relative contributions of output and unit fabricating charge to the rise in value added (processing charges) from 1919-58 may appear small (8 points) when compared with the increase of 145 percent in output and 70 percent in unit fabricating charges; see p. 23.

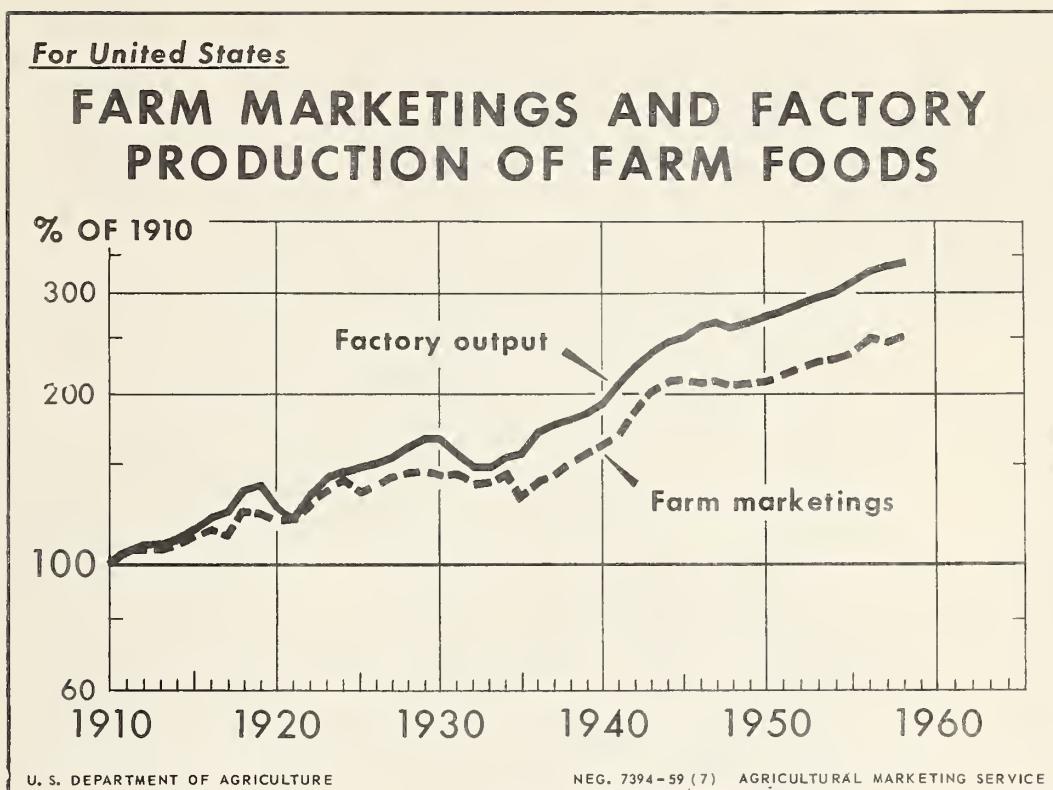


Figure 2

processing of farm food products is well dramatized by fruits and vegetables. At the end of the first decade of the century, processed (canned and dried) fruits accounted for about an eighth of total fruit consumption; currently the ratio is about half. The trend was roughly the same for vegetables.

Trends in Commodity Group Indexes

Trends in individual product group indexes varied widely. Figure 3 is a ratio chart constructed to compare rates of growth for the periods: Before 1939, from 1939 to 1947, and since 1947. During the five decades, from 1909 to 1958, the indexes for dairy products and processed fruits and vegetables rose markedly faster than the all-processed-food index (fig. 3). The index of poultry and processed eggs also has increased at a substantially faster rate than the all-processed-food index since 1929, the first year for which data are available. In contrast, output indexes for meat products and bakery and grain mill products increased less than the average. Sugar and confectionery products rose more rapidly before

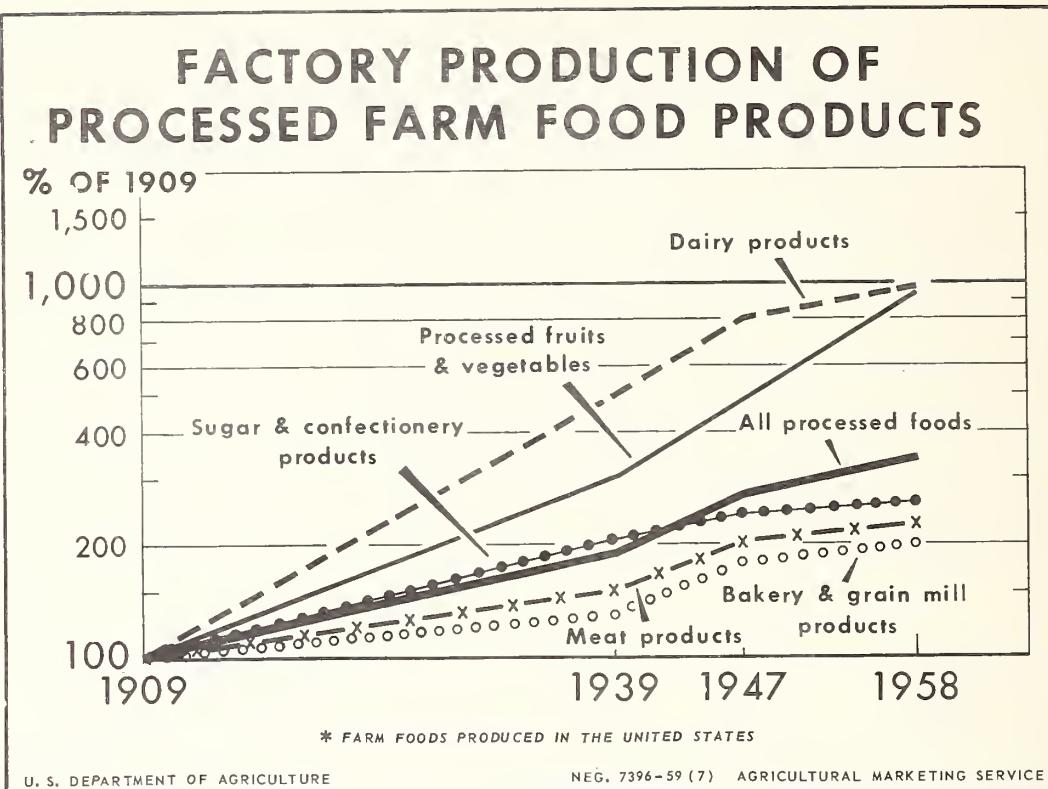


Figure 3

World War II than all foods combined, reflecting primarily the growth of the beet sugar industry, but since 1939 the increase has been relatively less than the average. Aside from sugar and confectionery products, the product groups that rose faster than average for all foods before World War II also rose faster than average after the War.

As a result of these divergent trends the relative importance of red meats and food grain products has declined. In 1909, meat products contributed 32 percent to the all-processed-food index and bakery and grain mill products 53 percent; in 1954 the respective percentages were 22 and 29. ^{11/} In contrast, dairy products contributed only 4 percent to the all-processed-food index in 1909 but 22 percent in 1954. The contribution of processed fruits and vegetables increased from 5 percent in 1909 to 14 percent in 1954.

^{11/} The base for making these comparisons excludes poultry and processed eggs because data are not available for 1909. In 1954, poultry and processed eggs contributed about 7 percent to the all-processed-food index.

